TYPE OF WORKMANSHIP RECOMMENDED TO SECURE Dry Brick Walls

A. I. A. File No. 5-A, "Brick Masonry Laying Methods"

6/92 T-AR Cement 2^{25}

FOREWORD

Leaky brick walls are probably the most misunderstood problem in the building industry, and the one about which the most misinformation has been published.

Most authorities agree that dry brick walls depend much more on proper design and good workmanship than on the brick or mortar used.

This paper makes no attempt to discuss design. Flashing and spandrel waterproofing—lintels designed to shed the water out of rather than into the wall—provision against expansion, contraction and deflection of floor and roof slabs, beams and trusses . . . these and all other construction details are the responsibility of the architect.

The purpose of this paper is to describe and illustrate the type of workmanship which, together with proper design, will insure watertight walls.

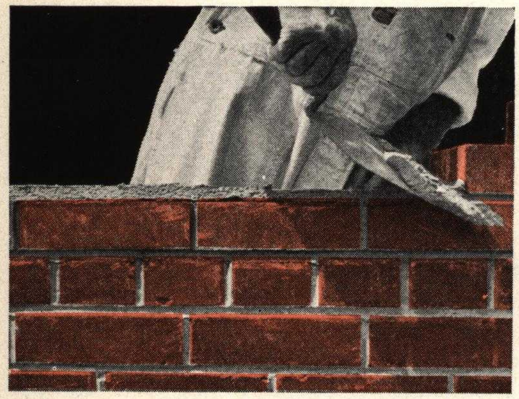
John H. Mallon, Vice-President
Louisville Cement Co., Louisville, Ky.

Copyright 1948, Louisville Cement Co., Incorporated
5th Printing

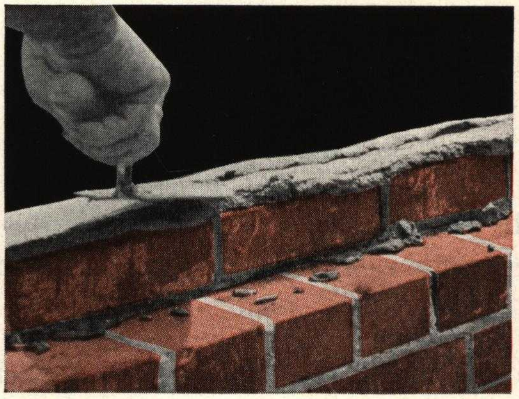
BED JOINTS

MORTAR for the bed joint should be spread thick. The furrow in the mortar should be made shallow, not deep.

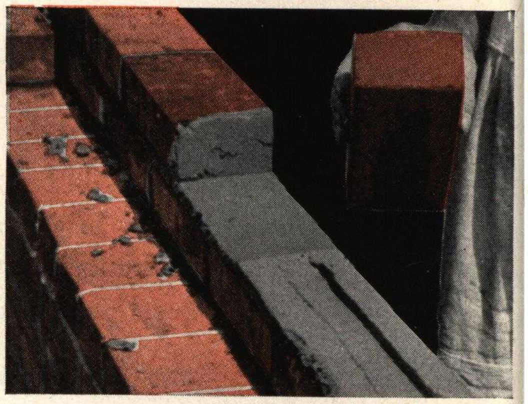
Then there will be enough excess mortar in the bed joint to completely fill the furrow when the brick are bedded to the line. This will give full bed joints.



A thick bed of mortar should be spread on the wall.

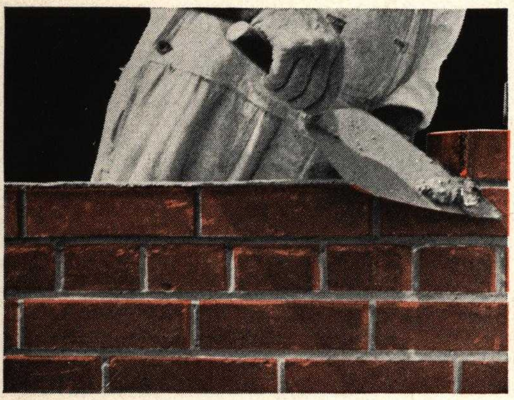


The furrow in the mortar should be shallow, not deep.

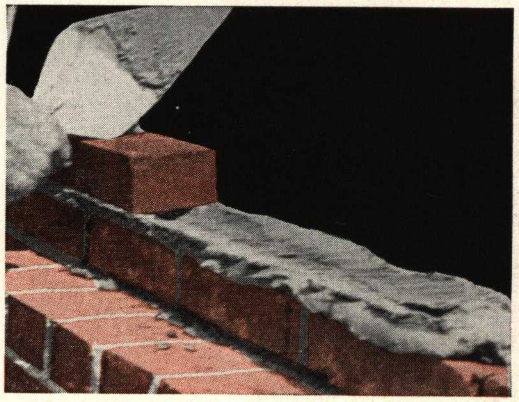


Then the excess mortar will fill the furrow and insure full bed joints.

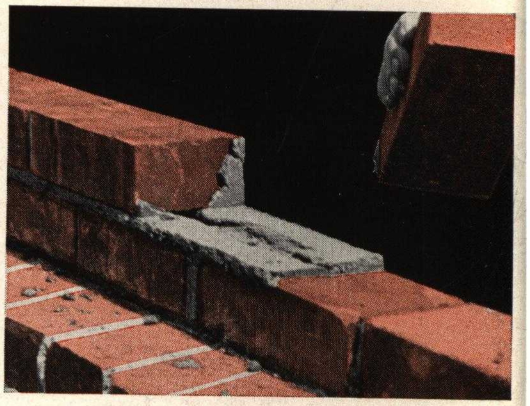
IF the mortar for the bed joint is spread too thin, or if the furrow in the mortar is made too deep, there will be insufficient mortar in the bed joint to completely fill the furrow, when the next course of brick is bedded. This will leave a channel along which water, entering from some open joint, may travel until it finds a passage to the inside of the wall.



The mortar in this bed joint is spread too thin.



The furrow in this bed joint is too deep.

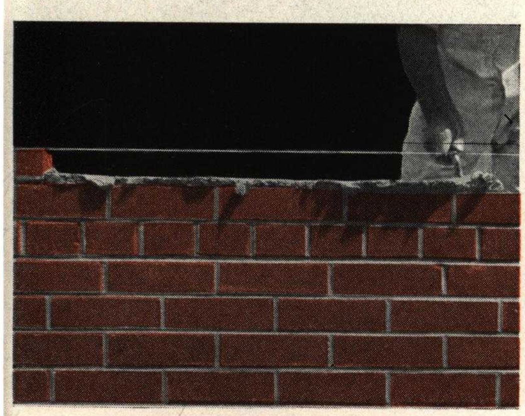


In either case there is not enough mortar in the bed joint to completely fill the furrow.

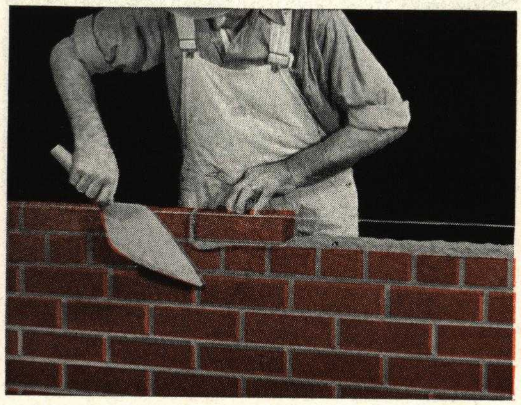
BED JOINTS (CONTINUED)

WHEN absorbent brick are used, especially in hot weather, mortar for the bed joint should be spread out over only a few brick at a time. The brick should be placed on top of this mortar immediately, before it has a chance to stiffen.

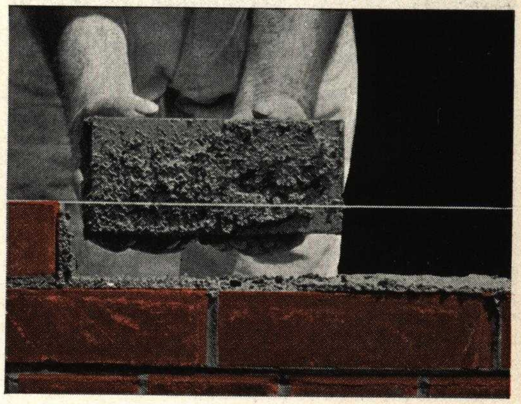
If the mortar is still soft and plastic when the brick are bedded, the mortar will stick to the brick placed on top of it as well as to the brick on which it is spread. This will give a good bond above as well as below the bed joint.



The mortar should be spread over a few brick only.

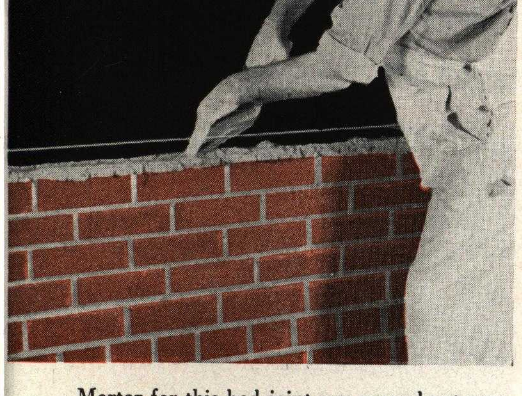


So the mortar will still be soft and plastic when the brick are bedded.

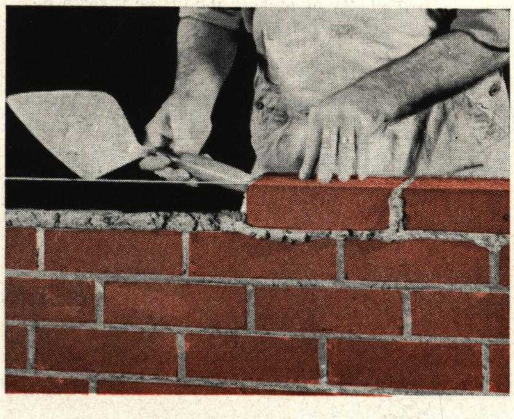


Then the mortar will stick to the brick placed on top of it as well as to the brick on which it is spread.

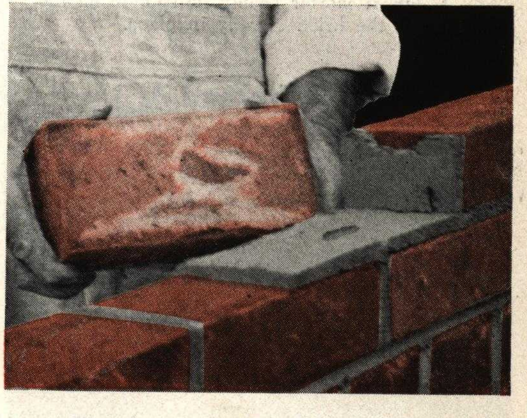
IF the mortar is spread out too far on the wall, or if any delay occurs between spreading the mortar and placing the brick on top of it, the mortar will be sucked dry before the next course of brick is bedded. In this case the mortar will not stick to the brick placed on top of it, and there will be no bond between the brick and the mortar.



Mortar for this bed joint was spread out on the wall too far.



So the mortar dried out too much before the next course of brick was placed on top of it.

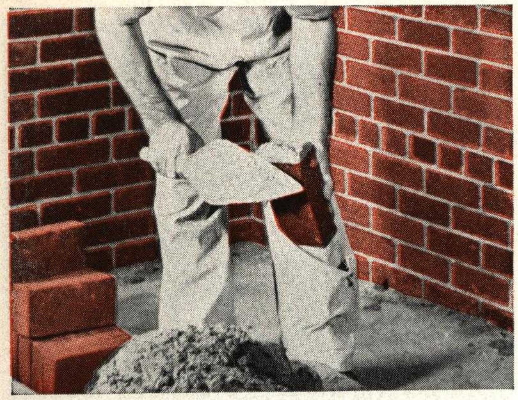


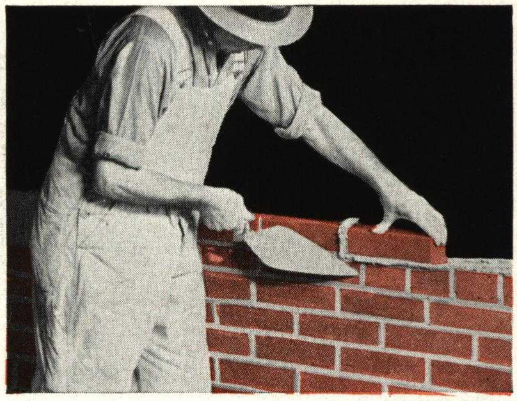
Therefore the mortar did not stick to the top brick. A good bond was not secured.

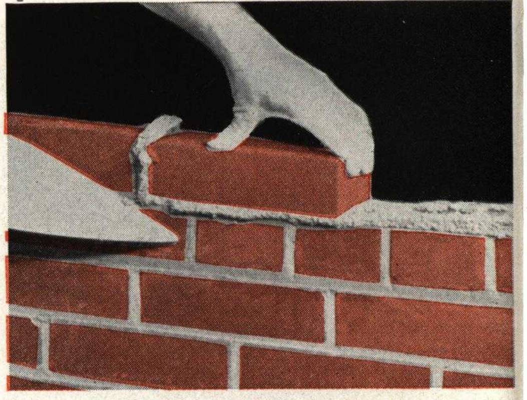
HEAD JOINTS IN STRETCHER COURSES

ALL head joints in both face brick and back-up work should be completely filled with mortar by using any of the following methods:

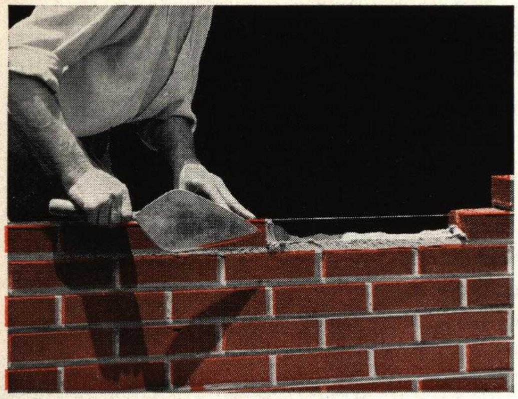
(Method 1) *Throw plenty of mortar on the end of the brick to be placed. (This should be done in such a way that the mortar is scraped off the trowel by the bottom edge of the end of the brick.) Then push the brick into place so that the mortar oozes out at the top of the head joint.*

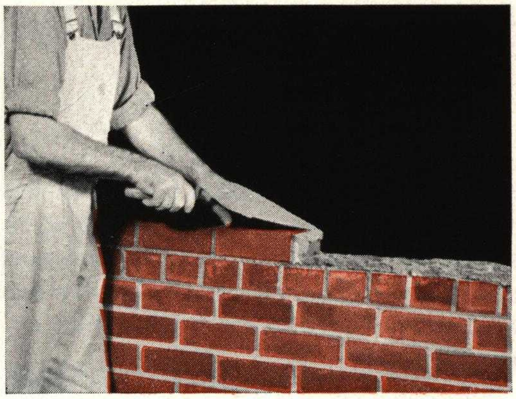

Plenty of mortar should be thrown on the end of the brick to be placed.

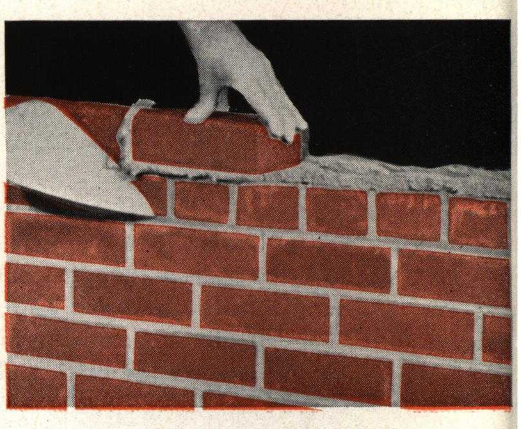

The brick should then be pushed into place.


So that the mortar oozes out at the top of the head joint.

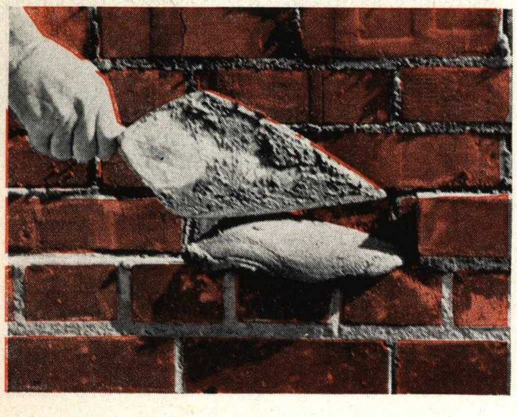
(Method 2) *Spot a dab of mortar on the corner of the brick already in place. Then also throw plenty of mortar on the end of the same brick, so there will be more than enough mortar to fill the joint completely, when the next brick is pushed into place.*

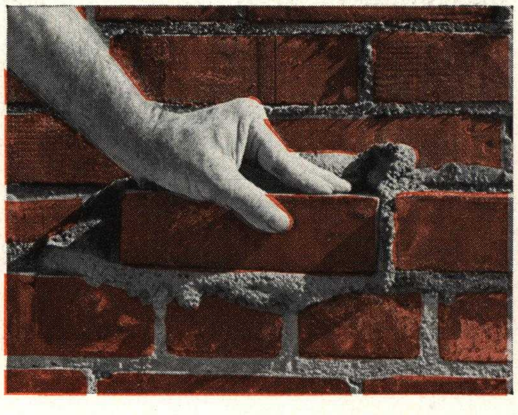

A dab of mortar should be spotted on the corner of the brick already in place.

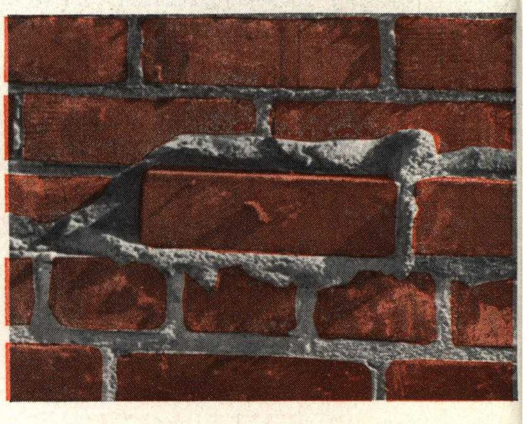

Then plenty of mortar should be thrown on the end of the brick already in place.


So there will be more than enough mortar to fill the joint completley when the next brick is pushed into place.

(Method 3) *Throw a deep bed of mortar on the wall; then shove the brick into place, so that the mortar oozes out at the top of the joint.*


A full trowel of mortar should be thrown on the wall.

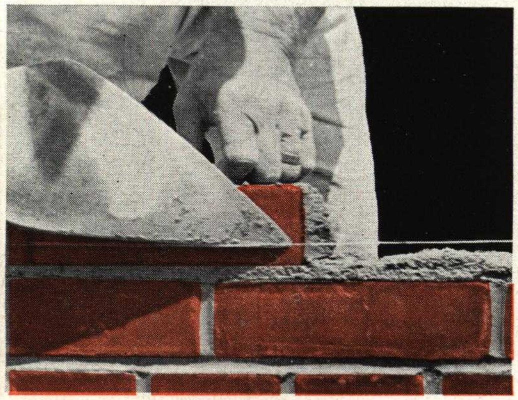

Then the brick should be shoved into this deep bed of mortar.


So that the mortar oozes out at the top of the joint.

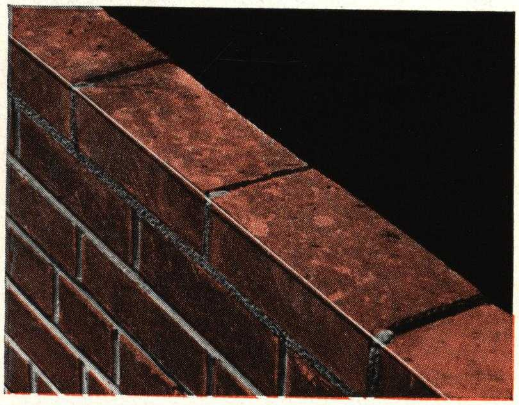
HEAD JOINTS IN STRETCHER COURSES (CONTINUED)

IF the head joints are not completely filled with mortar, in both face brick and back-up work, water may penetrate to the inside of the wall through openings in the joints.

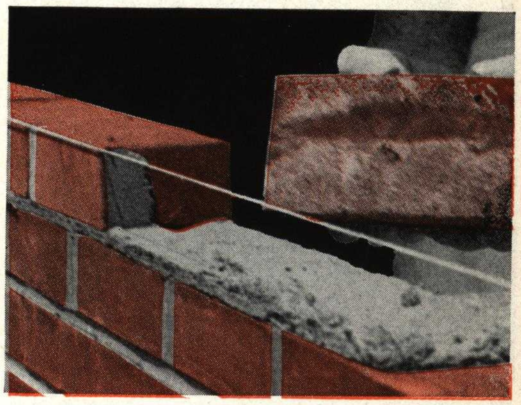
A dab of mortar spotted on one corner of the brick is not nearly enough to fill the head joint.



When a dab of mortar is spotted on one corner of the brick,

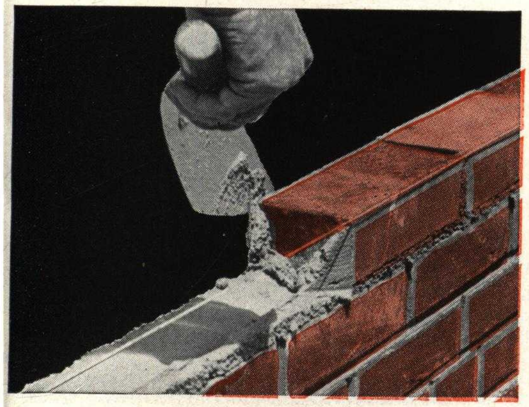


the mortar does not fill the head joint.

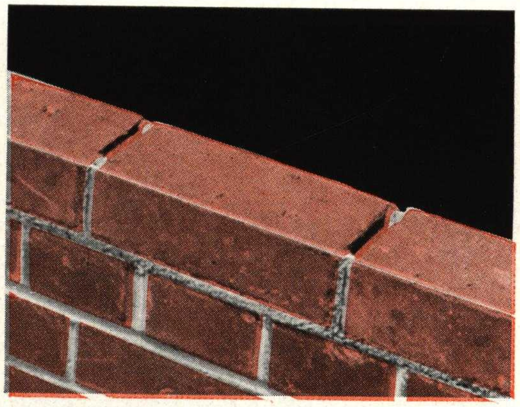


Only part of the head joint is filled with mortar.

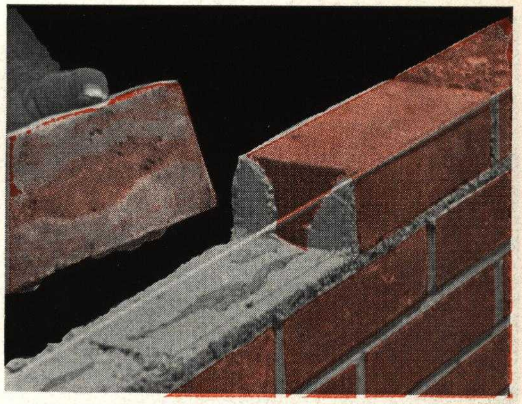
A dab of mortar spotted on both corners of the brick is still not enough to fill the head joint completely.



Even when a dab of mortar is spotted on both corners of the brick,

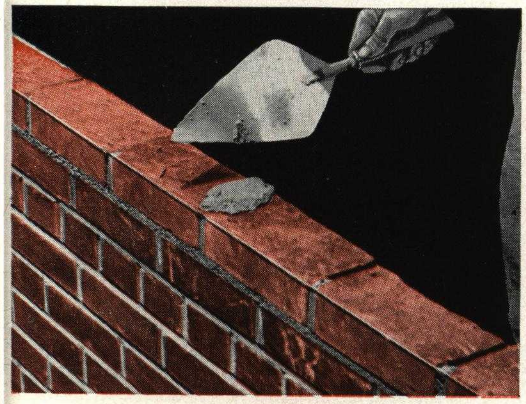


the mortar does not completely fill the head joint.

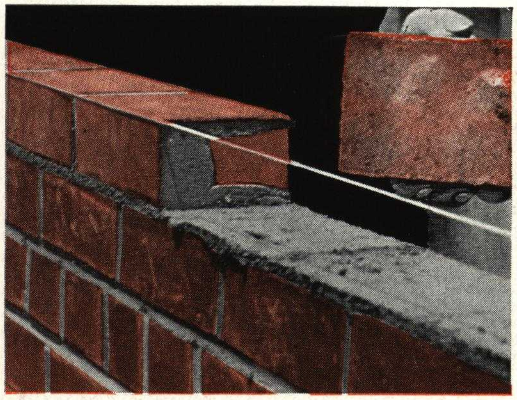


Voids are still left in the head joints.

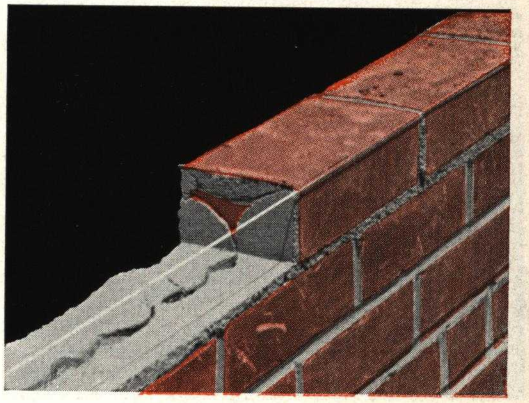
SLUSHING cannot be relied upon to completely fill voids left in the head joints.



Slushing does not properly fill the voids in the head joints.



When mortar is spotted on only one corner of the brick, slushing seldom fills the voids.

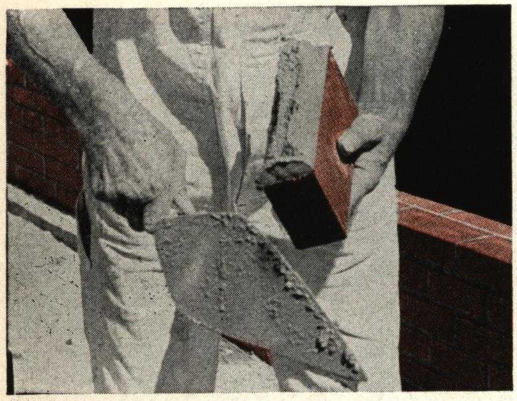


Even when mortar is spotted on both corners of the brick, slushing will not always fill the voids.

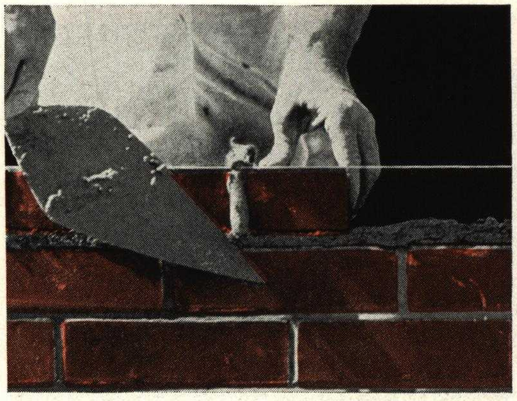
CROSS JOINTS IN HEADER COURSES

In header courses, all vertical joints should be completely filled with mortar by using the following method:

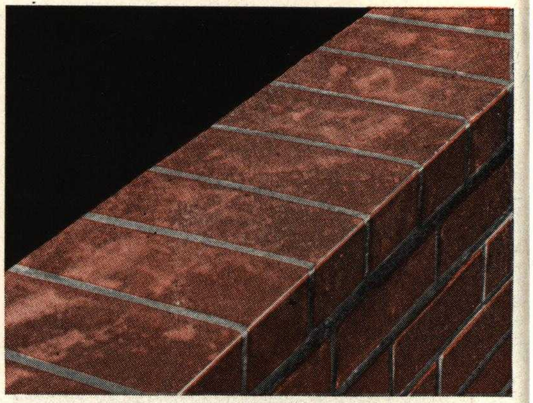
Spread mortar over the entire side of the header brick before it is placed in the wall. Then push the brick into place, so that the mortar oozes out at the top of the joint.



Mortar should be spread over the entire side of the header brick before it is placed on the wall.



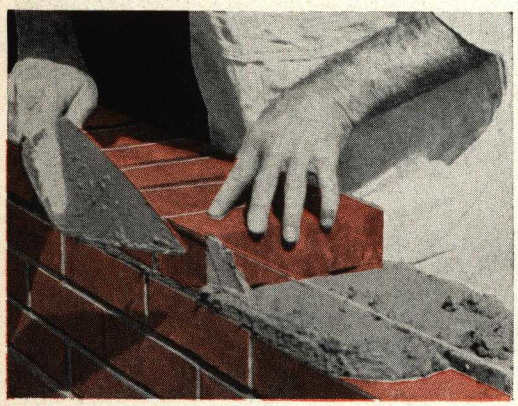
The brick should be shoved into place so that mortar oozes out at the top of the joint.



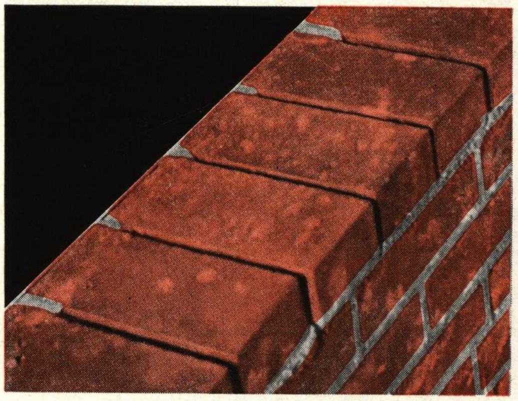
This completely fills the joint.

In header courses, full cross joints are seldom secured on the average job.

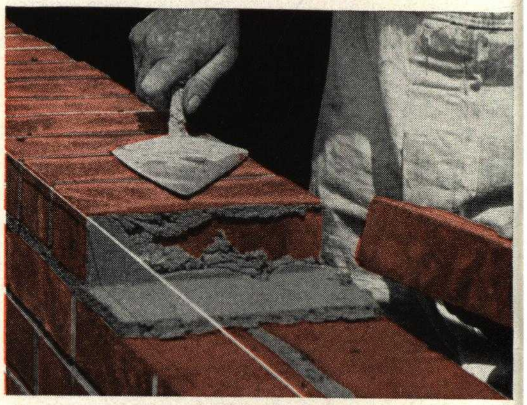
A dab of mortar spotted on one corner of the brick cannot possibly fill the cross joint. Slushing will not fill the voids.



When a dab of mortar is spotted on one corner of the brick,

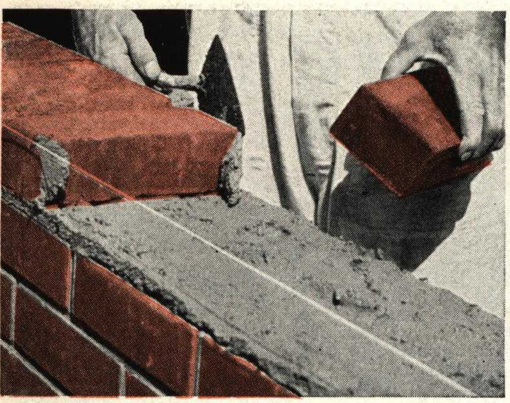


there is very little mortar in the cross joint.

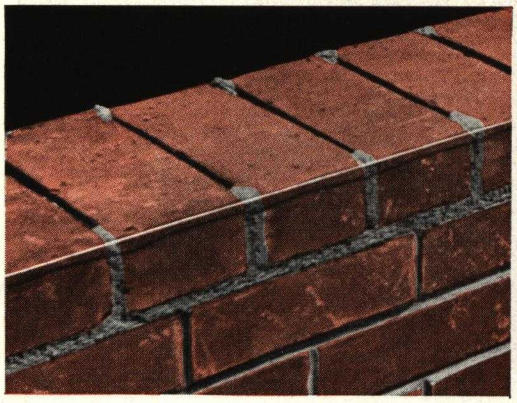


Slushing will not fill the voids.

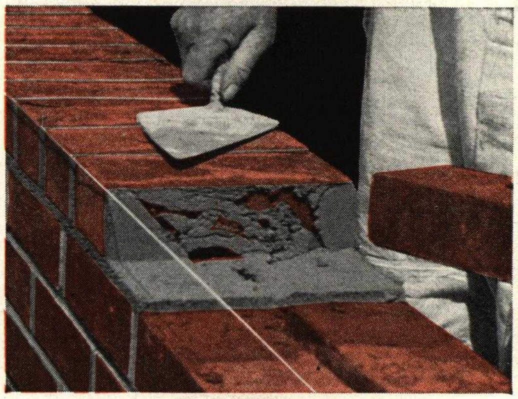
A dab of mortar spotted on both corners of the brick is not nearly enough to fill the joint. Slushing will seldom fill the voids completely.



Even when mortar is spotted on both corners of the header brick,



there is not enough mortar in the joint,

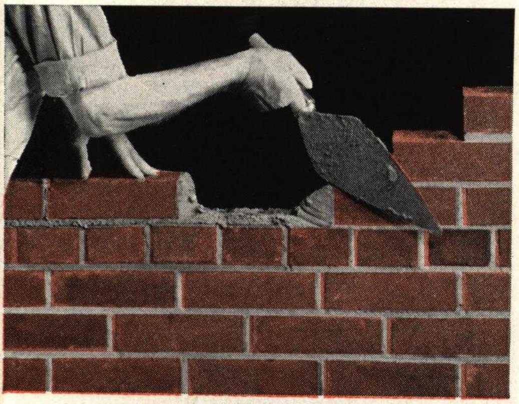


Slushing will seldom fill the voids.

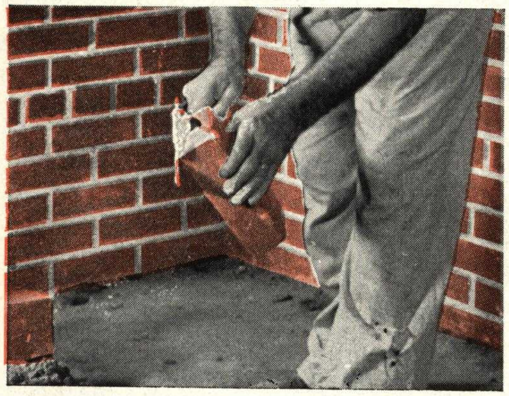
CLOSURES

CLOSURES IN STRETCHER COURSES

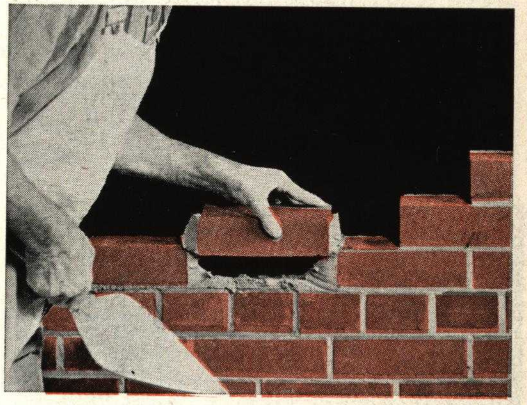
BEFORE placing the closure brick, mortar should be spotted on the ends of both brick already in place. In addition, mortar should be thrown onto both ends of the closure brick. The closure brick should then be laid without disturbing the brick already in place.



Mortar should be spotted on the ends of both brick already in place.



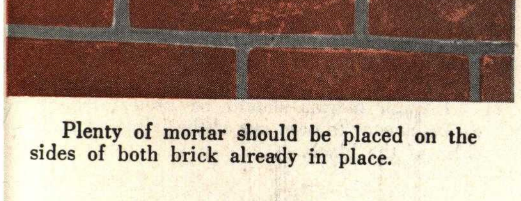
And in addition, mortar should be thrown on both ends of the closure brick.



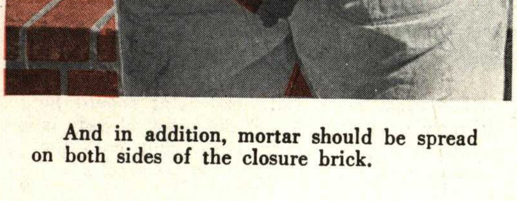
Then the closure brick should be laid without disturbing the brick already in place.

CLOSURES IN HEADER COURSES

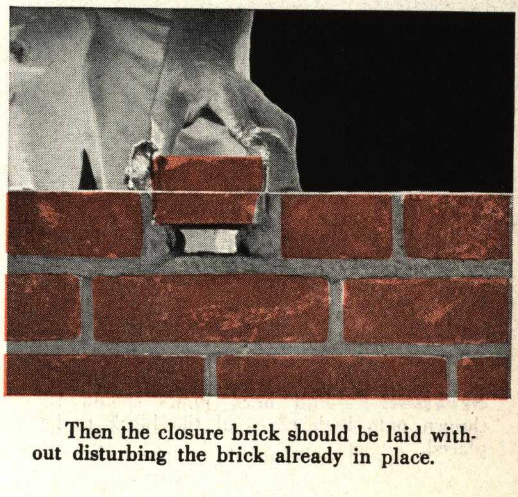
BEFORE laying the closure brick, plenty of mortar should be placed on the sides of both brick already in place. In addition, mortar should be spread on both sides of the closure brick. The closure brick should then be laid without disturbing the brick already in place.



Plenty of mortar should be placed on the sides of both brick already in place.



And in addition, mortar should be spread on both sides of the closure brick.



Then the closure brick should be laid without disturbing the brick already in place.

TILE OR BLOCK

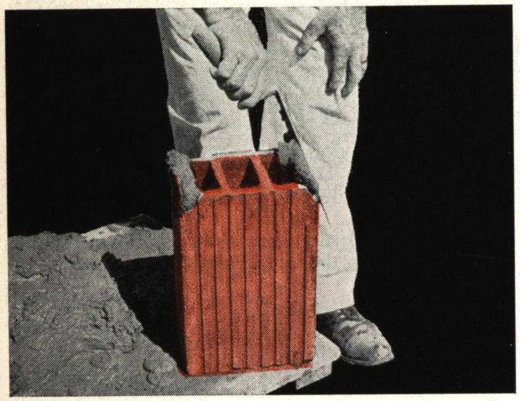
In laying clay tile, or concrete or cinder block, even when they are used for back-up work only, especial care should be exercised to secure full head joints on both the inside and the outside edges of the unit. Either of the following methods may be used:

(Method 1) *Throw up full head joints on both edges of the unit to be placed; or*

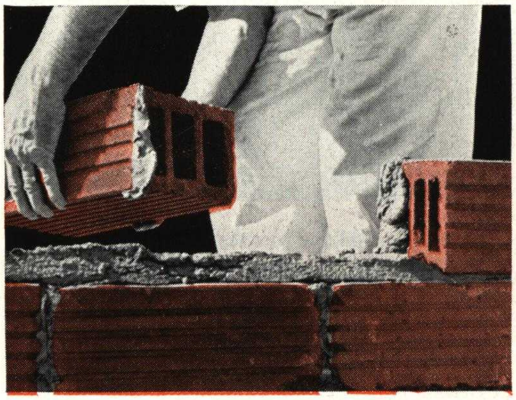
(Method 2) *Throw up a full head joint on the interior edge of the unit already in place, and also a full head joint on the opposite edge of the unit to be placed.*

With either of the above methods, in order to make sure the joints on both sides of the unit are completely filled, enough mortar should be used to cause excess mortar to ooze out of the joints on both sides of the unit.

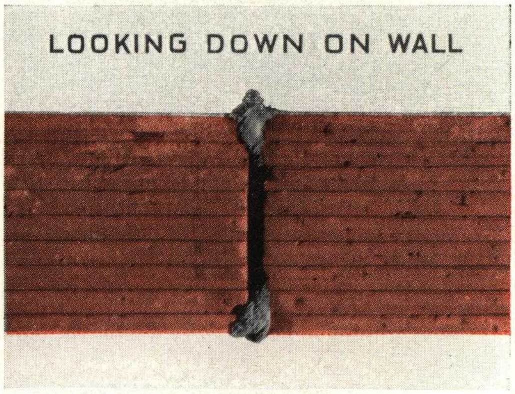
TILE



Method 1—Full head joints should be thrown onto both edges of the tile to be placed.

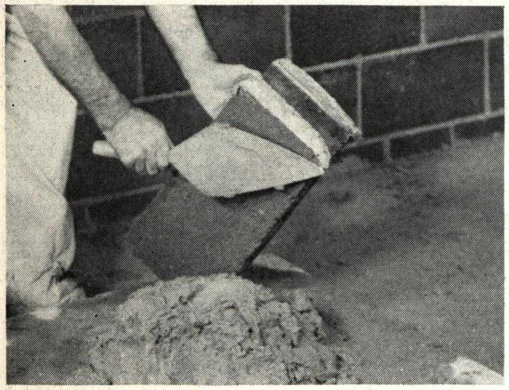


Method 2—A full head joint should be thrown onto one edge of the tile in place and also a full head joint onto the opposite edge of the tile to be placed.

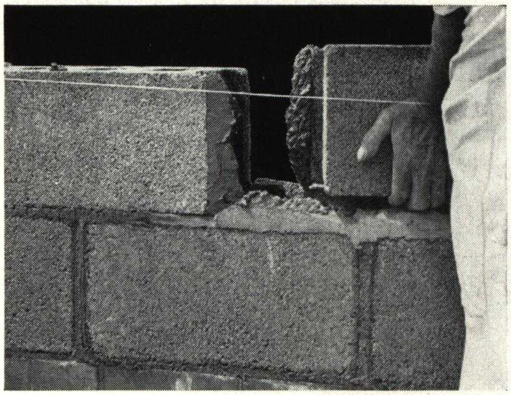


Enough mortar should be used to cause excess mortar to ooze out of the joints on both sides of the tile.

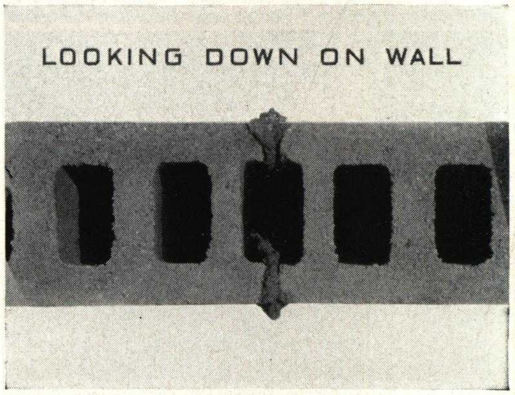
BLOCK



Method 1—Full head joints should be thrown onto both edges of the block to be placed.



Method 2—A full head joint should be thrown onto one edge of the block already in place and also a full head joint onto the opposite edge of the block to be placed.

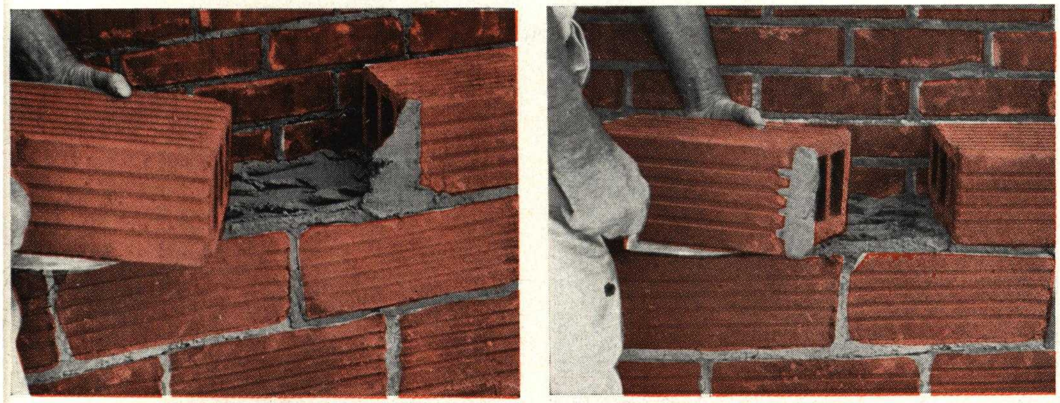


Enough mortar should be used to cause excess mortar to ooze out of the joints on both sides of the block.

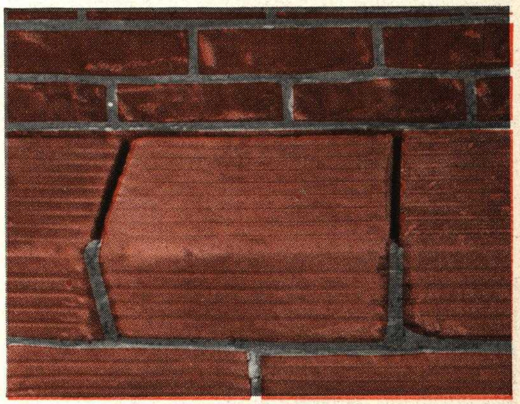
TILE OR BLOCK (CONTINUED)

TILE or block back-up units offer very little protection against the penetration of water, unless both inside and outside head joints in the back-up work are completely filled with mortar.

TILE

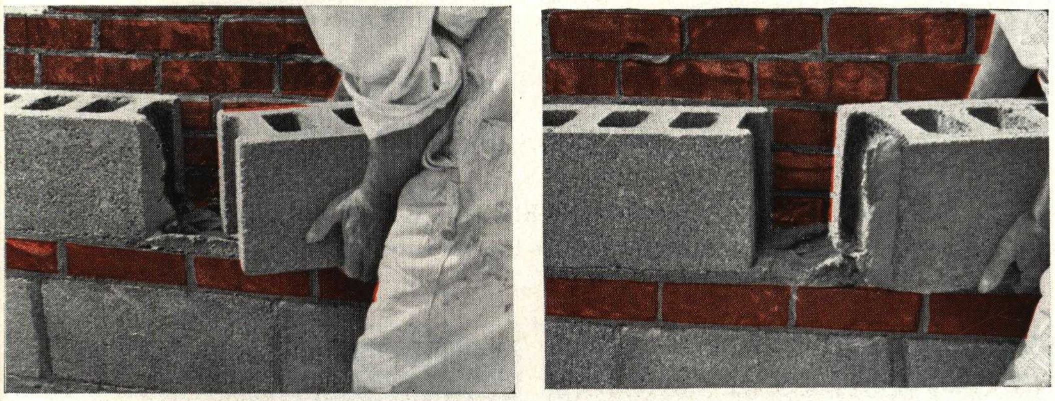


It is not sufficient to provide head joints on the inside face of the wall only. Both methods shown above leave open head joints in the interior of the wall, next to the face brick.

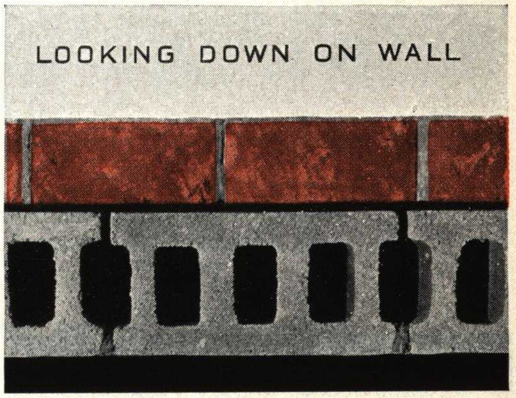


Such back-up work offers practically no protection against the penetration of water.

BLOCK



It is not sufficient to provide head joints on the inside face of the wall only. Both methods shown above leave open head joints in the interior of the wall, next to the face brick.



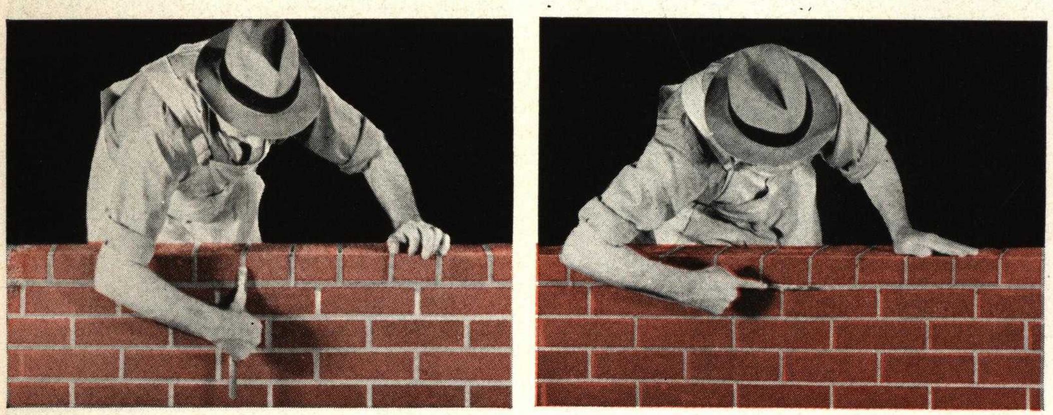
Such back-up work offers practically no protection against the penetration of water.

TYPE OF JOINT

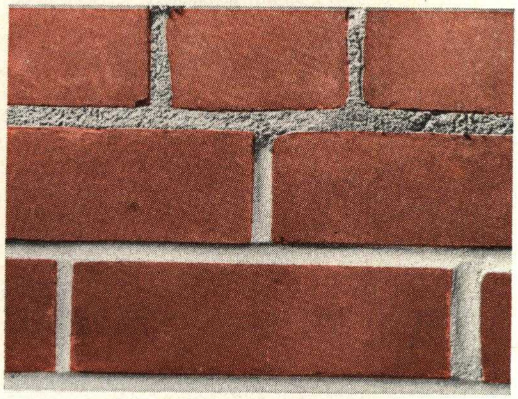
ALL joints on the exterior face of the wall should be tooled to give a concave finish.

This should be done with a round tool slightly larger than the joint, before the mortar hardens, and with sufficient force to press the mortar tight against the brick on both sides of the mortar joint.

Such tooling helps seal any cracks between the mortar and the brick which may have been left when the brick were laid.

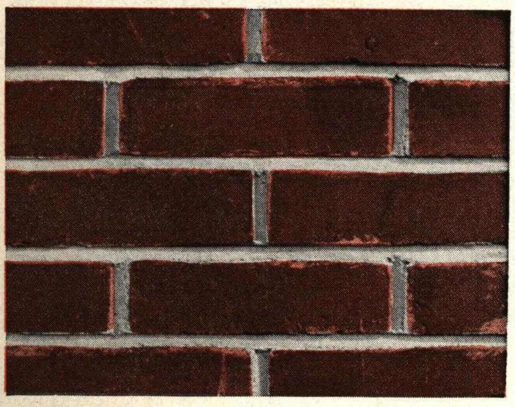


Before the mortar hardens, joints should be finished to give a concave surface. This should be done with a round tool slightly larger than the joint, and with sufficient force to press the mortar tight against the brick on both sides of the mortar joint.

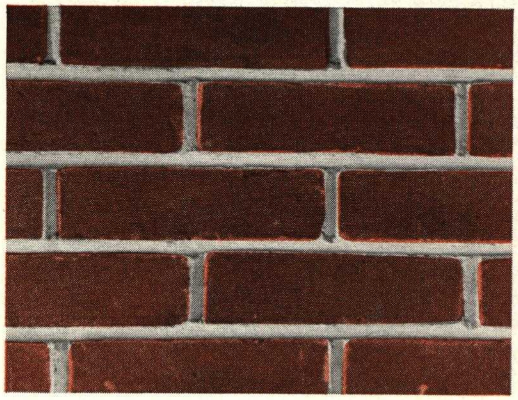


This helps seal any cracks between the brick and the mortar which may have been left when the brick were laid.

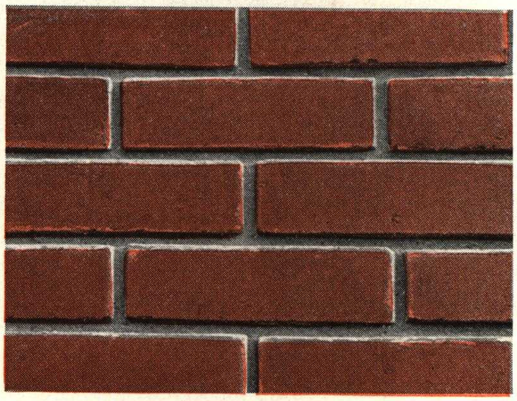
CONCAVE joints should always be used for face brick, unless the architecture requires some other type of finish. No other type of joint provides as much protection against the entrance of water.



A weathered joint does not always pack the mortar against the top brick thoroughly.

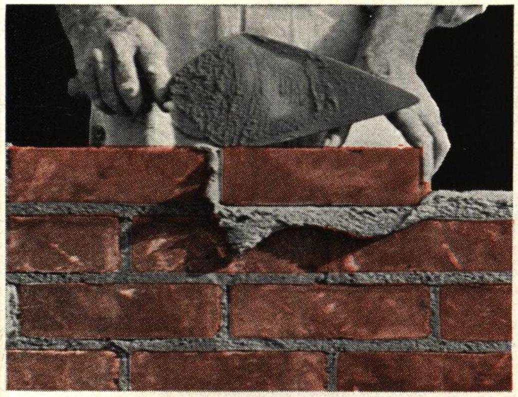


A struck joint leaves a shelf on which water collects.

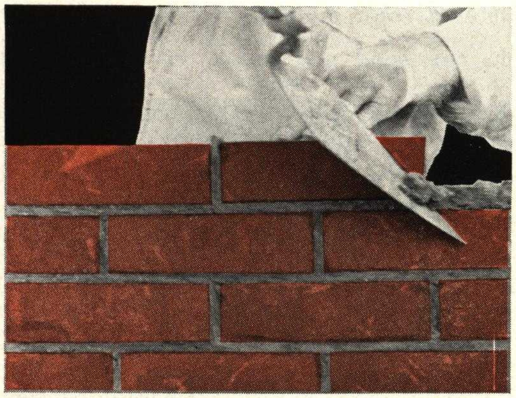


A raked joint leaves a bad shelf and often contains too little mortar especially in the head joint.

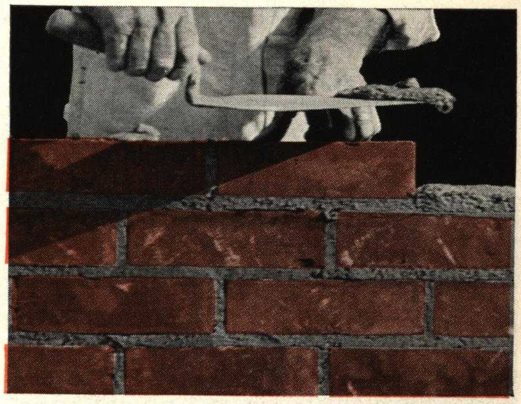
WHEN joints are cut flush with the brick, cracks are immediately apparent between the brick and the mortar at the surface of the wall. These cracks do not extend back through the entire width of the brick. They run back only a fraction of an inch. Such cracks are not due to shrinkage. The pictures below explain how they occur.



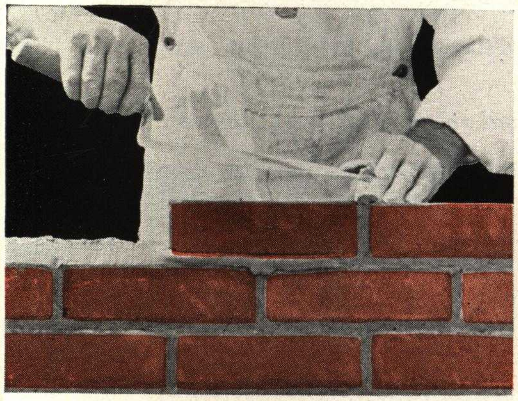
When the bricklayer taps the brick down to the line, the mortar in the bed joint oozes out, and hangs down over the wall, pulling away from the edge of the brick above.



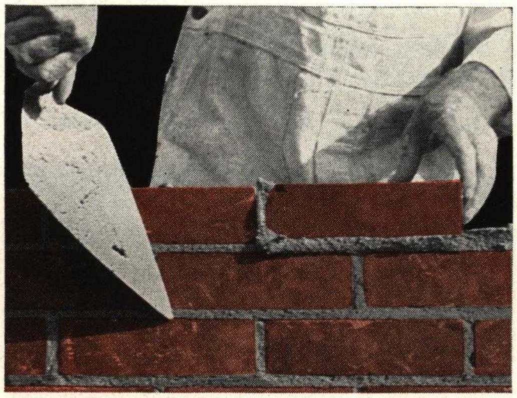
Then if the mortar in the bed joint is cut off with a sideways stroke of the trowel, the mortar is not pushed up against the edge of the brick above, and a crack remains on top of the bed joint.

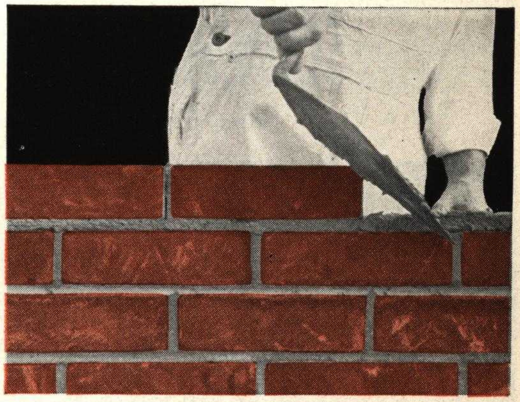


If the mortar in the bed joint is cut off with an upward stroke, the trowel frequently pulls the mortar away from the edge of the brick below, and a crack is opened below the bed joint.



The head joint should be cut off with an upward stroke of the trowel.



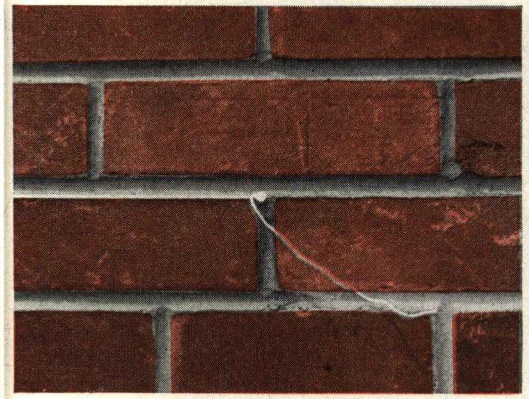


If a sideways stroke of the trowel is used to cut off the head joint, the trowel frequently pulls the mortar away from the edge of the brick and forms a crack on the side of the mortar joint from which the stroke was made.

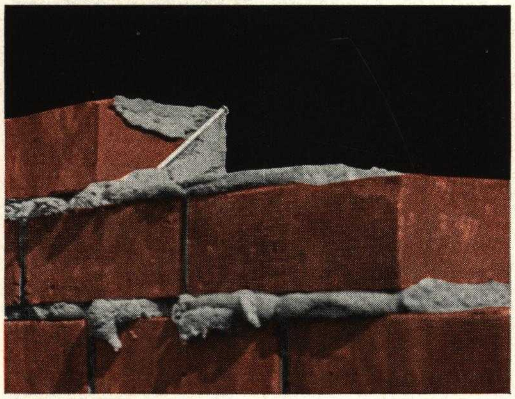
NAIL HOLES

WHEN a nail or line-pin is used, the hole should be immediately plugged with mortar when the nail is removed.

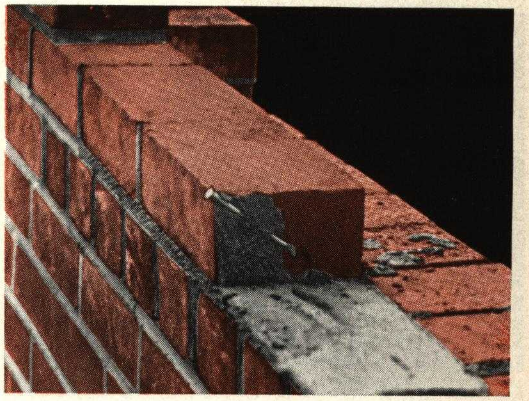
Nail holes sometimes connect with voids in the head joints, which, in turn, connect with unfilled furrows in the bed joints. Water entering through the nail holes may travel through connecting voids, until it finds a passage to the inside of the building.



When a nail or line pin is used, the hole should be plugged with mortar as soon as the nail is removed.



Nail holes frequently connect with voids in the head joints which in turn connect with unfilled furrows in the bed joint.



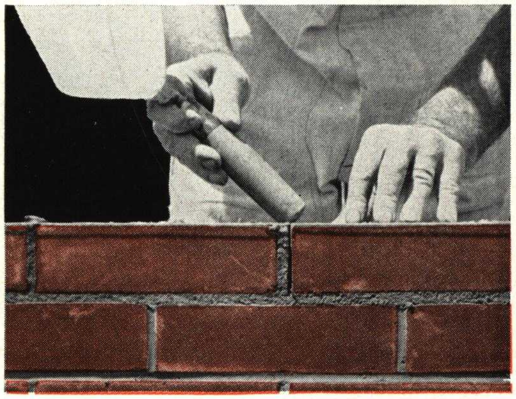
Water entering through the nail holes may travel through connecting voids and find an opening to the inside of the building.

SHIFTING POSITION OF BRICK

THE position of the brick should never be shifted after they have been laid. If brick have been improperly spaced, so there is too little or too much space for the closure brick, and it is necessary to correct the width of the head joints, the brick and the mortar should be removed from the wall, and the brick should be relaid with fresh mortar.

Shifting the brick breaks the bond and causes cracks between the brick and the mortar.

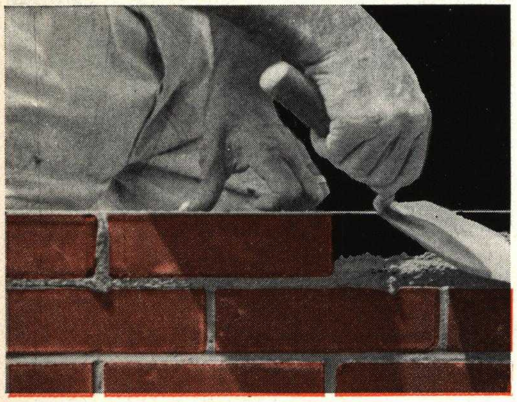
After the brick have once been laid,



thereafter, the position of the brick should never be changed. Shifting the brick breaks the bond between the brick and the mortar, and causes cracks in the wall.

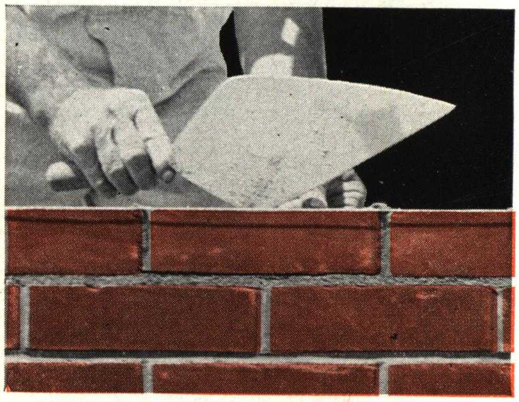
BRICK must be laid true to the line, when originally placed. If any delay occurs before they are tapped into place, the bond will be broken, and a crack will result.

Any brick which are disturbed after laying should be removed and relaid with fresh mortar.



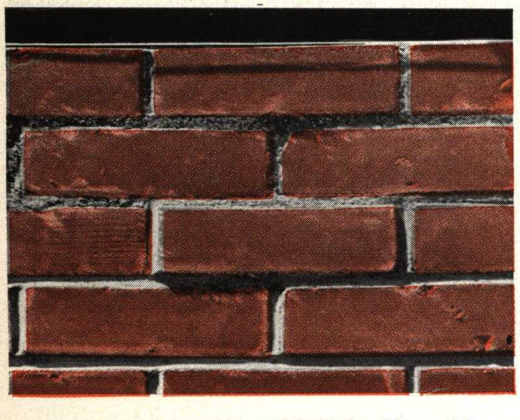
If a brick is not laid true to the line when originally placed,

and if the bricklayer comes back and taps it into place later,

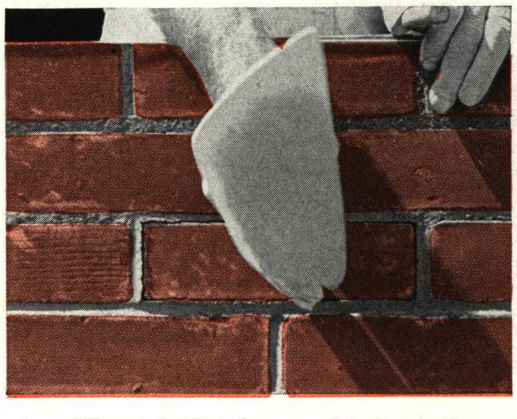


cracks will result.

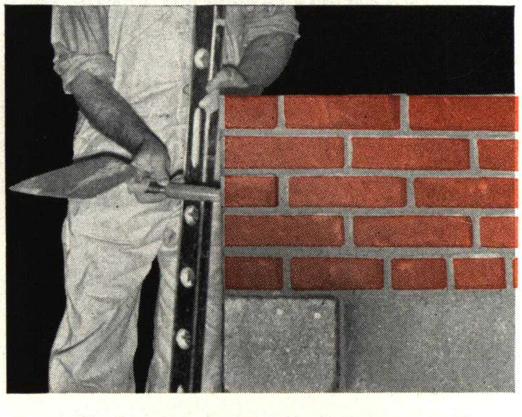
REALIGNMENT of a brick should not be attempted after a higher or following course of brick has been laid. Tapping back a protruding brick will break the bond and leave a crack.



Realignment of a brick should not be attempted after a higher or following course has been laid.



When a brick is hammered back into line, the bond between the brick and mortar is broken.



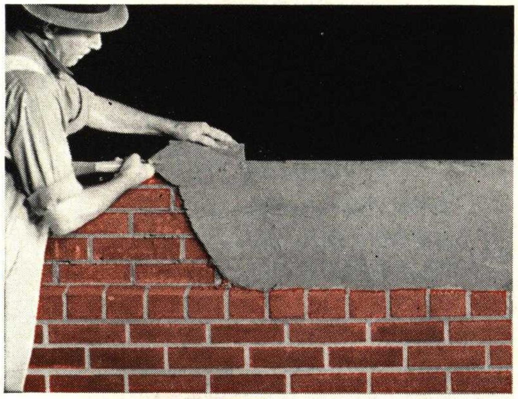
Cracks due to such realignment are frequently found at the corners of the wall.

PARGING

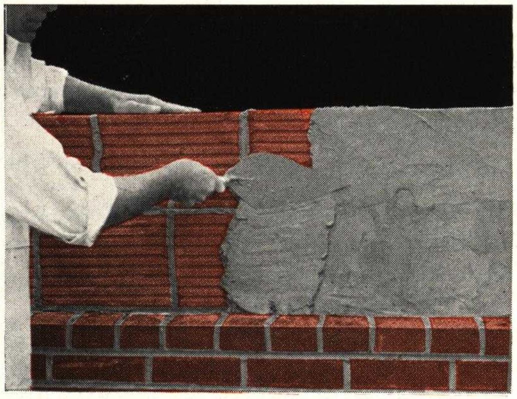
THE face brick should be backplastered with not less than 3/8 of an inch of mortar before the back-up units are laid.

Or, if the back-up units are laid first, the front of the back-up units should be plastered with not less than 3/8 of an inch of mortar before the face brick are laid.

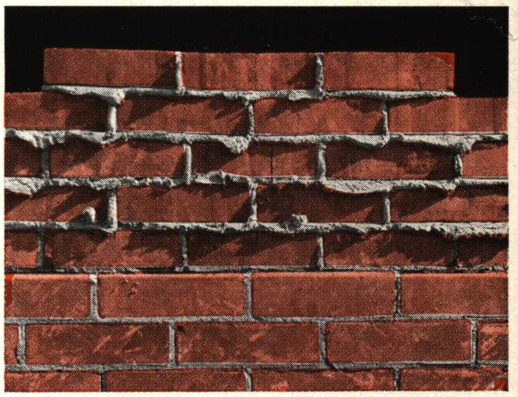
Before the face brick are backplastered, however, the joints on the back of the face brick should be cut flush. The backplastering should not be done over mortar protruding from the joints.



The face brick should be backplastered.



If the back-up units are laid first, the front of the back-up units should be plastered.



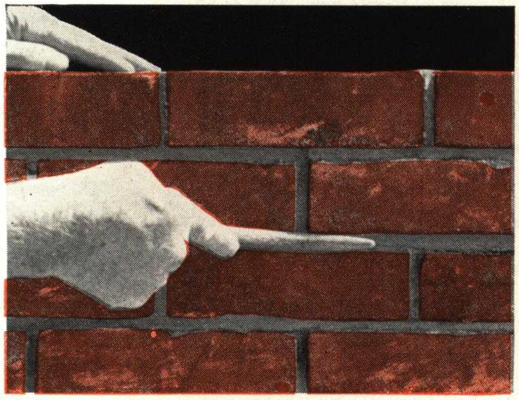
Backplastering should not be attempted over protruding mortar joints.

TOOLING JOINTS AS AN ALTERNATE FOR PARGING

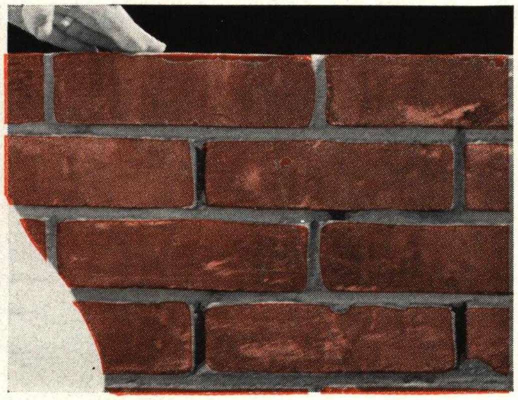
AS an alternate for backplastering, the joints on the back of the face brick may be tooled to give a concave finish.

This should be done with a round tool slightly larger than the joint, before the mortar hardens, and with sufficient force to press the mortar tight against the brick on both sides of the mortar joint.

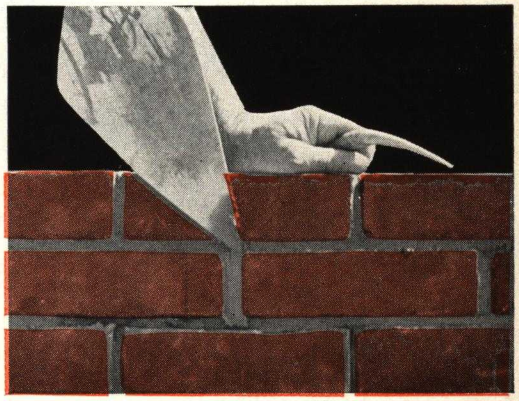
This helps seal any cracks between the brick and the mortar, which may have been left when the brick were laid. Also, it encourages the bricklayer to fill the head joints, since open joints cannot be properly tooled.



As an alternate for backplastering, the joints on the back of the face brick may be tooled to give a concave finish.



Such tooling cannot be properly done if mortar is lacking.



Before the tooling can be completed, it is necessary for the bricklayer to point up the open joints.

BRICK

Except in freezing weather, all brick (except highly impervious brick) should be wetted thoroughly a few hours before they are laid in the wall. A stream of water should be played on the pile of brick, until each individual brick has been thoroughly soaked.

Wetting of absorbent brick is necessary to reduce the rate of suction of the brick, so that they will not suck the water out of the mortar too fast. If the absorption is too rapid, so much water is removed from the mortar by the dry brick that the mortar congeals and does not bond properly with the next brick placed in contact with it.

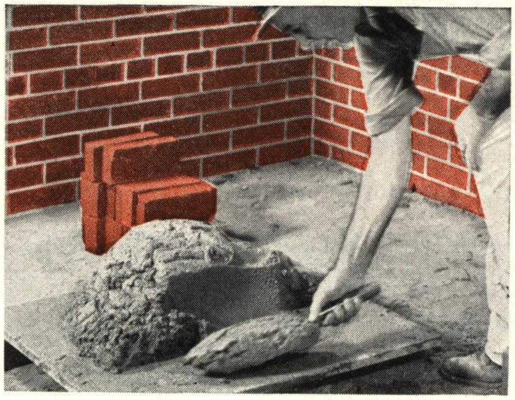
MORTAR

Mortar on the boards should be kept well tempered with water so it will be soft and workable when placed in the wall.

The mortar should be plastic to enable the bricklayer to properly bed the brick and fill the joints.

The mortar should have high water-retaining capacity to keep the brick from sucking the water out of the mortar too fast when spread out on the wall. The mortar must stay soft and plastic long enough to permit a thorough bedding of the brick and to secure a good bond with the brick.

Mortar on the boards should be kept well tempered with water.



Mortar should be plastic to enable the bricklayer to properly bed the brick and fill the joints.

Mortar should have high water-retaining capacity to keep the brick from sucking the water out of the mortar too fast.

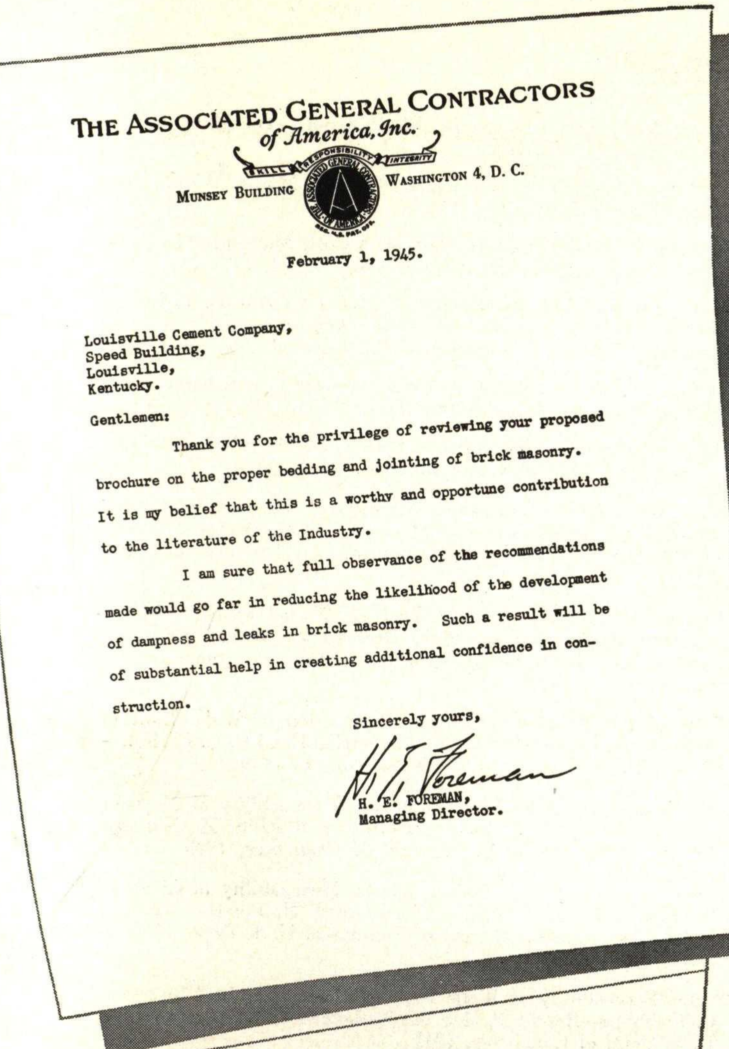
BRIXMENT FOR MORTAR

For over twenty-five years, Brixment has been recognized as the leading masonry cement. It is designed to produce mortar combining plasticity, water retention, bonding quality, strength, durability and freedom from efflorescence.

Two of the outstanding characteristics of Brixment mortar are its excellent plasticity and its high water-retention.

Because it has these characteristics to such a high degree, Brixment mortar furnishes as great protection against leaky brick walls as can be secured with any kind or type of mortar materials.

LOUISVILLE CEMENT COMPANY, *Incorporated*, Louisville, Kentucky



THE ASSOCIATED GENERAL CONTRACTORS
of America, Inc.
SKILL RESPONSIBILITY INTEGRITY
MUNSEY BUILDING WASHINGTON 4, D. C.

February 1, 1945.

Louisville Cement Company,
Speed Building,
Louisville,
Kentucky.

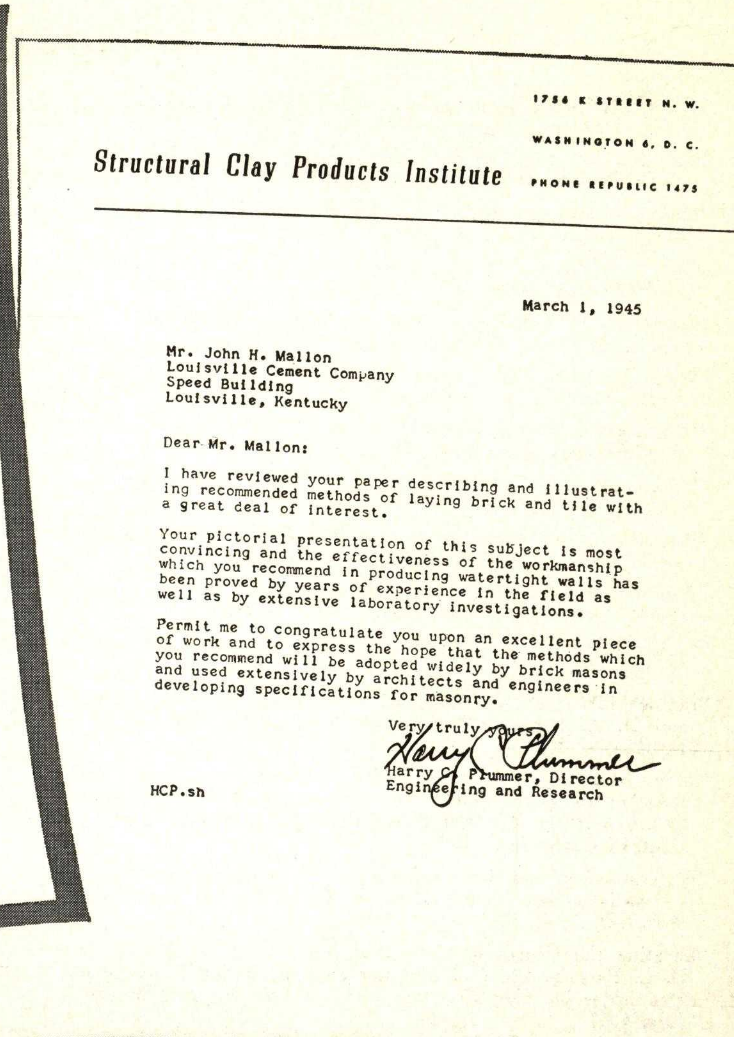
Gentlemen:

Thank you for the privilege of reviewing your proposed brochure on the proper bedding and jointing of brick masonry. It is my belief that this is a worthy and opportune contribution to the literature of the Industry.

I am sure that full observance of the recommendations made would go far in reducing the likelihood of the development of dampness and leaks in brick masonry. Such a result will be of substantial help in creating additional confidence in construction.

Sincerely yours,

H. E. Foreman
H. E. FOREMAN,
Managing Director.



Structural Clay Products Institute
1756 K STREET N. W.
WASHINGTON 6, D. C.
PHONE REPUBLIC 1475

March 1, 1945

Mr. John H. Mallon
Louisville Cement Company
Speed Building
Louisville, Kentucky

Dear Mr. Mallon:

I have reviewed your paper describing and illustrating recommended methods of laying brick and tile with a great deal of interest.

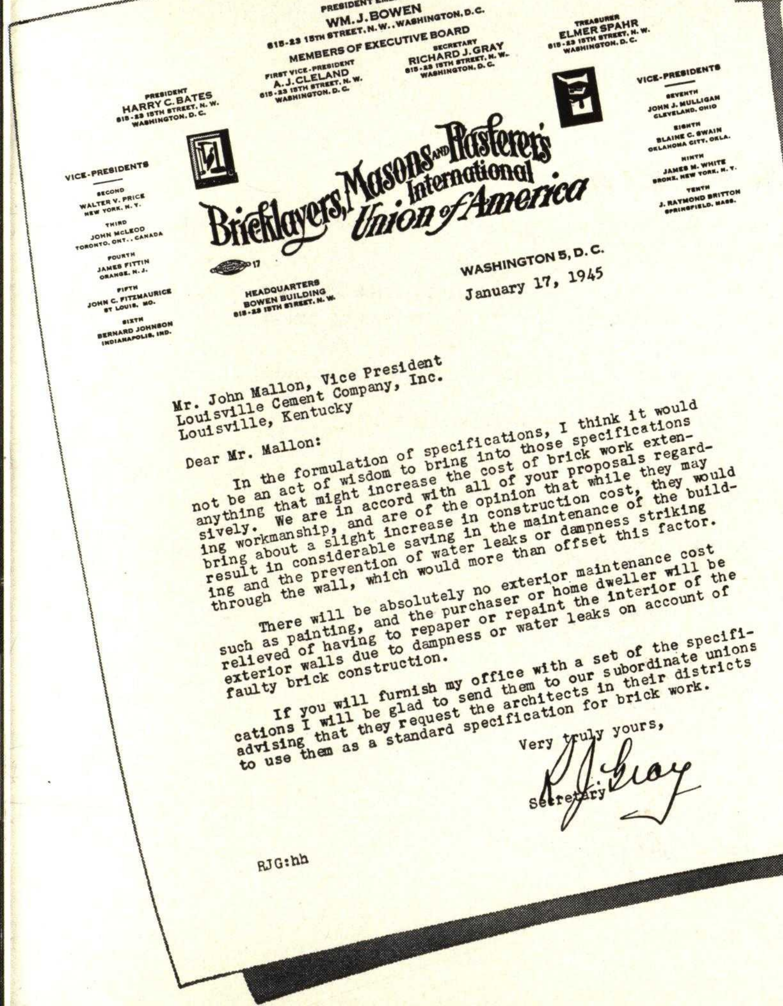
Your pictorial presentation of this subject is most convincing and the effectiveness of the workmanship which you recommend in producing watertight walls has been proved by years of experience in the field as well as by extensive laboratory investigations.

Permit me to congratulate you upon an excellent piece of work and to express the hope that the methods which you recommend will be adopted widely by brick masons and used extensively by architects and engineers in developing specifications for masonry.

Very truly yours,

Harry C. Plummer
Harry C. Plummer, Director
Engineering and Research

HCP.sh



PRESIDENT EMERITUS
WM. J. BOWEN
815-23 15TH STREET, N. W., WASHINGTON, D. C.
MEMBERS OF EXECUTIVE BOARD

PRESIDENT
HARRY C. BATES
815-23 15TH STREET, N. W.
WASHINGTON, D. C.

FIRST VICE-PRESIDENT
A. J. CLELAND
815-23 15TH STREET, N. W.
WASHINGTON, D. C.

SECRETARY
RICHARD J. GRAY
815-23 15TH STREET, N. W.
WASHINGTON, D. C.

TREASURER
ELMER SPAHR
815-23 15TH STREET, N. W.
WASHINGTON, D. C.

VICE-PRESIDENTS
SECOND
WALTER V. PRICE
NEW YORK, N. Y.
THIRD
JOHN McLEOD
TORONTO, ONT., CANADA
FOURTH
JAMES FITTIN
ORANGE, N. J.
FIFTH
JOHN C. FITZMAURICE
ST LOUIS, MO.
SIXTH
BERNARD JOHNSON
INDIANAPOLIS, IND.

VICE-PRESIDENTS
SEVENTH
JOHN J. MULLIGAN
CLEVELAND, OHIO
EIGHTH
BLAINE C. SWAIN
OKLAHOMA CITY, OKLA.
NINTH
JAMES M. WHITE
BRONX, NEW YORK, N. Y.
TENTH
J. RAYMOND BRITTON
SPRINGFIELD, MASS.

Bricklayers, Masons and Plasterers' International Union of America

17

HEADQUARTERS
BOWEN BUILDING
815-23 15TH STREET, N. W.

WASHINGTON 5, D. C.

January 17, 1945

Mr. John Mallon, Vice President
Louisville Cement Company, Inc.
Louisville, Kentucky

Dear Mr. Mallon:

In the formulation of specifications, I think it would not be an act of wisdom to bring into those specifications anything that might increase the cost of brick work extensively. We are in accord with all of your proposals regarding workmanship, and are of the opinion that while they may bring about a slight increase in construction cost, they would result in considerable saving in the maintenance of the building and the prevention of water leaks or dampness striking through the wall, which would more than offset this factor.

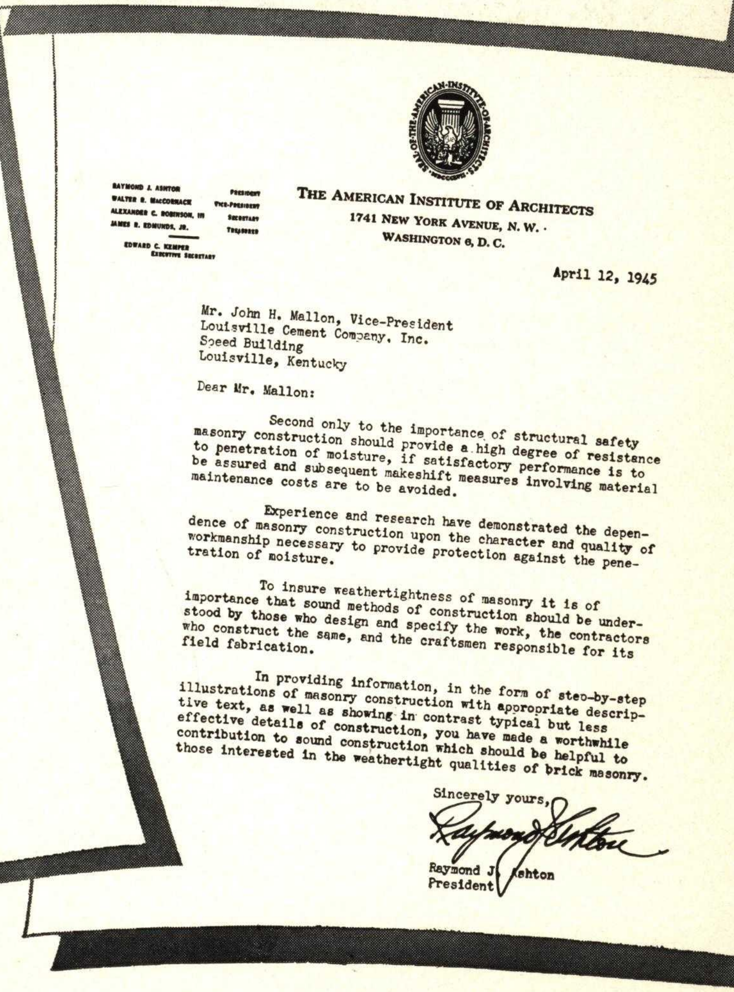
There will be absolutely no exterior maintenance cost such as painting, and the purchaser or home dweller will be relieved of having to repaper or repaint the interior of the exterior walls due to dampness or water leaks on account of faulty brick construction.

If you will furnish my office with a set of the specifications I will be glad to send them to our subordinate unions advising that they request the architects in their districts to use them as a standard specification for brick work.

Very truly yours,

R. J. Gray
Secretary

RJG:hh



RAYMOND J. ASHTON President
WALTER R. MACCORNACK Vice-President
ALEXANDER C. ROBINSON, III Secretary
JAMES R. EDMUNDS, JR. Treasurer

EDWARD C. KEMPER
Executive Secretary

THE AMERICAN INSTITUTE OF ARCHITECTS
1741 NEW YORK AVENUE, N. W.
WASHINGTON 6, D. C.

April 12, 1945

Mr. John H. Mallon, Vice-President
Louisville Cement Company, Inc.
Speed Building
Louisville, Kentucky

Dear Mr. Mallon:

Second only to the importance of structural safety masonry construction should provide a high degree of resistance to penetration of moisture, if satisfactory performance is to be assured and subsequent makeshift measures involving material maintenance costs are to be avoided.

Experience and research have demonstrated the dependence of masonry construction upon the character and quality of workmanship necessary to provide protection against the penetration of moisture.

To insure weathertightness of masonry it is of importance that sound methods of construction should be understood by those who design and specify the work, the contractors who construct the same, and the craftsmen responsible for its field fabrication.

In providing information, in the form of step-by-step illustrations of masonry construction with appropriate descriptive text, as well as showing in contrast typical but less effective details of construction, you have made a worthwhile contribution to sound construction which should be helpful to those interested in the weathertight qualities of brick masonry.

Sincerely yours,

Raymond J. Ashton
Raymond J. Ashton
President

BIBLIOGRAPHY

"Some Practices in Erecting Damp-Proof Tile-and-Brick Walls," by P. H. Bevier—*Engineering News Record,* Feb. 16, 1928

"Choosing Structural Systems and Materials," by Theodore Crane—*The Architectural Forum,* May, 1929

"Making Buildings Rainproof," by Stanley Newman—*General Building Contractor,* July, 1930

"Can the Rain Get In," by John E. Nicholson—*The American Architect,* July, 1930

"Essentials of Good Brickwork," by Hugo Filippi, M.W.S.E.—*Journal of the Western Society of Engineers,* Aug., 1930

"Watertight Brick Masonry," by Dr. F. O. Anderegg—*The Architectural Record,* Sept., 1931

"Moisture Penetration Through Masonry Walls"—*Bulletin of the Boston Society of Architects,* Dec., 1931

"Exterior Wall Construction," by L. B. Lent—*General Building Contractor,* Feb., 1932

"Properties and Problems of Masonry Cements," by J. C. Pearson—*Journal of the American Concrete Institute,* Feb., 1932

"Rate of Stiffening of Mortars on a Porous Base," by L. A. Palmer and D. A. Parsons—*Rock Products,* Sept. 10, 1932

"Leaky Brick Walls and How to Prevent Them," by John H. Mallon—*The Architectural Record,* Dec., 1932

"Permeability Tests of 8-Inch Brick Wallettes," by L. A. Palmer and D. A. Parsons—*Proceedings of A.S.T.M.,* Vol. 54, Part II, 1934

"A Study of the Properties of Mortars and Bricks and Their Relation to Bond," by L. A. Palmer and D. A. Parsons—*Research Paper R P 683,* National Bureau of Standards, U. S. Dept. of Commerce, 1934

"Waterproofing and Dampproofing," by Tyler Stewart Rogers—American Architect Reference Data No. 17; *American Architect,* April, 1935

"Locating the Causes of Rain Penetration of Brick Walls," by D. E. Parsons, Chief of Masonry Section, National Bureau of Standards—*Building Economy and The Modern Brickbuilder,* July, 1937

"Better Brickwork," by Charles W. Hammett—The Hammett Co. Washington, D. C., 1937

"Cracks in Housing Project Walls," by B. J. Myren—*Engineering News Record,* March 17, 1938

"How To Build Leaky Brick Walls with Good Materials," by A. B. MacMillan—*Engineering News Record,* Dec. 1, 1938

"Water Permeability of Masonry Walls," by Cyrus C. Fishburn, David Watstein and Douglas E. Parsons—Report B M S 7, National Bureau of Standards, U. S. Dept. of Commerce, 1938

"Avoiding Cracks in Building Walls," by Fred N. Severud, Consulting Engineer—*Engineering News Record,* July 6, 1939

"Brick Engineering," by Harry C. Plummer and Leslie J. Reardon—Structural Clay Products Institute, Washington, D. C., 1939

"Watertightness and Transverse Strength of Masonry Walls," by Douglas E. Parsons, Chief of Masonry Section, National Bureau of Standards—Published by Structural Clay Products Institute, 1939

"Cracks in Exterior Masonry Bearing Walls Occuring Where Concrete Roof and Floor Slabs Bear on the Walls," by A. M. Korsmo and B. M. Thorud—*Journal of the American Concrete Institute,* Sept., 1940

"Tests of the Resistance to Rain Penetration of Walls Built of Masonry and Concrete," by R. E. Copeland and C. C. Carlson—Proc. American Concrete Institute, Vol. 36, 1940

"Effects of Wetting and Drying on the Permeability of Masonry Walls," by Cyrus C. Fishburn—Report B M S 55, National Bureau of Standards, U. S. Dept. of Commerce, 1940

"Effect of Heating and Cooling on the Permeability of Masonry Walls," by Cyrus C. Fishburn and Perry H. Petersen—Report B M S 41, National Bureau of Standards, U. S. Dept. of Commerce, 1940

"Water Permeability of Walls Built of Masonry Units," by Cyrus C. Fishburn—Report B M S 82, National Bureau of Standards, U. S. Dept. of Commerce, 1942

Digitized by:

INTERNATIONAL

ASSOCIATION
FOR
PRESERVATION
TECHNOLOGY,
INTERNATIONAL
www.apti.org

BUILDING
TECHNOLOGY
HERITAGE
LIBRARY

https://archive.org/details/buildingtechnologyheritagelibrary

From the collection of:
Mike Jackson, FAIA